Table 1 Ecosystems, prey species, and food web models used

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| --- | --- | --- | --- |
| Ecosystem | Region code | Prey functional groups | Food web model |
| North Sea | NORT | Atlantic herring, Lesser sandeel, Norway pout, Common sole, Whiting | ? |
| Barents Sea | BS | Atlantic herring, Capelin | (Blanchard *et al.*, 2002) |
| Baltic Sea | BALT | Atlantic herring, Sprat | (Harvey *et al.*, 2003) |
| Southern Gulf of St. Lawrence | sGoSL | Small demersal feeders, Capelin, Planktivorous small pelagics, Flounders | (Savenkoff *et al.*, 2004)- 1980s food web |
| Western Scotian Shelf | WSS | Atlantic herring, Other pelagics | (Araújo *et al.*, 2011) |
| Eastern Scotian Shelf | ESS | Northern sand lance, small pelagics | (Bundy, 2004) |
| Gulf of Maine | GoM | Commercial pelagics, Other pelagics | (Link *et al.*, 2006) |
| Georges Bank | GB | Commercial pelagics, Other pelagics | (Link *et al.*, 2006) |
| Hecate Strait | HS | Pacific herring, Flatfish | (Ainsworth *et al.*, 2002) |
| Gulf of Alaska | GoA | Pacific herring, Walleye Pollock, Capelin | (Aydin *et al.*, 2002) |
| Eastern Bering Sea | EBS | Pacific herring, Walleye pollock, Capelin, Yellowfin sole, Pacific sand lance | (Aydin *et al.*, 2002) |

Macintosh HD:Users:okenk:Dropbox:Chapter2:figs:vf-examples.pdfFig. 1 Examples of systems that display (a) asynchrony, (b) statistically independent populations, and (c) synchrony. Individual predators (or populations) are in thin grey, and their re-centered sum is in thick black. Scales are identical.

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Fig. 2 Histograms of proportion of predation mortality in the mass balance model (a) for which time series data were available, (b) accounted for by the most important predator, and (c) accounted for by the second-most important predator.

Macintosh HD:Users:okenk:Dropbox:Chapter2:figs:pred-indices.pdfFig. 3 Predator index for all prey species in all regions. Each color slice represents a different predator species. For simplicity, only the predator index of the top ten predators is plotted. This makes up at least 92% of the total index, and an average of 99%. See appendix for predator species labels.

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Fig. 4 Variance factor of predator index for (a) all predator species or (b) the minimum number of species to account for 90% of the averaged total (reduced variance factor), versus number of species included. Additional lines mark where the variance factor equals 1 (statistically independent) and where the average correlation among predators is 0.05 (synchronous, >1) and -0.05 (asynchronous; <1). Black circles around points indicate it fell outside of the middle 95% of bootstrapped variance factors under the independent predator assumption. See table 1 for region codes.

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Fig. 5 Distribution of bootstrapped reduced variance factors under the assumption that predator populations are independent, along with observed variance factors (points). Horizontal line is where the variance factor equals one, the theoretical mean of the distributions. Numbers on top indicate number of predators. Points without distributions have one predator that accounts for >90% of predation index, and thus the reduced variance factor must equal one. Points in the tails of the distributions indicate evidence for synchronous (above) or asynchronous (below) predators. See table 1 for region codes.

**References**

Ainsworth, C., Heymans, J. J. S., Pitcher, T., and Vasconcellos, M. 2002. Ecosystem models of Northern British Columbia for the time periods 2000, 1950, 1900 and 1750.

Araújo, J. N., Bundy, A., Fisheries, D. of, and Oceans, N. P. E. D. 2011. Description of three Ecopath with Ecosim ecosystem models developed for the Bay of Fundy, Western Scotian Shelf and NAFO Division 4X. Population Ecology Division, Fisheries and Oceans Canada, Bedford Institute of Oceanography.

Aydin, K. Y., Lapko, V. V., Radchenko, V. I., and Livingston, P. A. 2002. A comparison of the eastern Bering and western Bering Sea shelf and slope ecosystems through the use of mass-balance food web models. US Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Alaska Fisheries Science Center.

Blanchard, J. L., Pinnegar, J. K., and Mackinson, S. 2002. Exploring Marine Mammal-fishery Interactions Using’Ecopath with Ecosim’: Modelling the Barents Sea Ecosystem. Ministry of Agriculture, Fisheries and Food, Centre for Environment, Fisheries and Aquaculture Science.

Bundy, A. 2004. Mass balance models of the eastern Scotian Shelf before and after the cod collapse and other ecosystem changes. Department of Fisheries and Oceans.

Harvey, C. J., Cox, S. P., Essington, T. E., Hansson, S., and Kitchell, J. F. 2003. An ecosystem model of food web and fisheries interactions in the Baltic Sea. ICES Journal of Marine Science: Journal du Conseil, 60: 939–950.

Link, J. S., Griswold, C. A., Methratta, E. M., and Gunnard, J. 2006. Documentation for the energy modeling and analysis exercise (EMAX). Northeast Fisheries Science Center Reference Document, 6: 166.

Savenkoff, C., Bourdages, H., Swain, D. P., Despatie, S.-P., Hanson, J. M., Méthot, R., Morissette, L., *et al.* 2004. Input data and parameter estimates for ecosystem models of the southern Gulf of St. Lawrence(mid-1980 s and mid-1990 s). Can. Tech. Rep. Fish. Aquat. Sci./Rapp. Tech. Can. Sci. Halieut. Aquat.: 111.